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ABSTRACT

A six-year program providing training for ten individuals in science education and seven in mathematics education research is described. Lists of program objectives, requirements and course work for the program, and faculty members involved are included along with information on selection of trainees, enrollment by year, resulting dissertation titles, and present location of graduates. (DT)

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Science and Mathematics Education Research Training Program

September 1972

Sponsor - U. S. Department of Health, Education and Welfare-
Office of Education

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ABSTRACT

The six year program provided training for 10 individuals in science education and 7 in mathematics education research. The trainees came from the United States and all had a 2.75 or better GPA and had earned a M.S. degree prior to admission.

Program

Each mathematics education candidate, prior to completion of the program, completed course work in mathematics equivalent to that required for the M.S. in mathematics.

Each science education candidate, prior to the completion of the program, completed a minimum of one year of course work in biology, chemistry, physics, and earth science, the equivalent in course work of the M.S. in one of the disciplines, and a minimum of one year of calculus.

Course work supplementing the science and mathematics courses related to research training included statistical analysis, research design, curriculum development; philosophy of education, science education and/or mathematics education, computers and psychology of learning.

Each candidate planned an individual research project following his participation in a research practicum. The course work of the trainees included academic offerings of many departments in the University and the individual research involved the following University of Wisconsin centers and laboratories; 1. Center for Research Design, 2. Scientific Literary Research Center, 3. Survey Research Center, 4. Mass Communication Research Center, 5. University Computing Center, and 6. Educational Research and Development Center as well as the State Department of Public Instruction and many local school systems and universities in the U.S.A.

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Science and Mathematics Education

Research Training Program 1966-1972

Milton O. Pella, Director
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Madison, Wisconsin

September 1972

The Research Training Program herein reported was carried on pursuant to a grant from the Office of Education, U.S. Department of Health, Education, and Welfare

Final Report on USOE Science and Mathematics Research Trainee Program

University of Wisconsin - Madison, Wisconsin 53706

1966-1972

The Science and Mathematics Research Training Program was conducted at this University for a period of six years. During this time each trainee enrolled who completed the program, earned the Ph.D. degree, and subsequently was employed in a college or university where he has been able to conduct himself commensurate with his training.

The trainee program consisted of four parts: a. academic preparation in science or mathematics; b. academic preparation in science or mathematics education to include statistics, research design, curriculum development, philosophy, and psychology; c. working 8-10 hours per week on research under an experienced researcher for at least one year; and d. completing one research project on a topic of his selection. Each of the trainees devoted more than 600 hours to research during the term of the program.

Throughout the period of training each trainee had available to him, on this campus, the services of the a. Center for Research Design, b. Scientific Literacy Research Center, c. Survey Research Laboratory, d. Mass Communication Research Center, e. University Computing Center, and f. Education Research and Development Center, as well as the counsel of scholars from all academic departments.

The trainees were selected from the U.S.A. on the basis of merit. Each year announcements were sent to leading institutions in the U.S. inviting applicants to apply to the program.

A. Program Objectives

1. General Objectives

To prepare capable students as research specialists in Science Education and Mathematics Education.

2. Specific Objectives

a. To develop academic competence in Science and Mathematics.

b. To develop competence in the design and conduct of several varieties of research: clinical, experimental, survey, etc.

c. To provide experience in research areas in the schools.

d. To stimulate interest in educational research.

e. To develop a reasonable philosophic background for the researcher (Ph.D Degree).

B. Program

1. Each Mathematics Education trainee, prior to completing the program, completed course work in mathematics equal to that required for the M.S. in mathematics.

2. Each Science Education trainee, prior to completing the program, completed one year of course work in biology, chemistry, earth science, and physics, course work equal to that required for the M.S. in one of the disciplines, and a mimimum of one year of calculus.

3. The trainees developed competence in research as a result of: year 1 - successfully completing courses devoted to research design, devoting 6-8 hours per week to a research project working as a member of a research team or under an experienced researcher,

and years 2 and 3 - devoting 8-10 hours per week to a research project of his own. Each trainee devoted more than 600 hours to research during the program and completed at least one piece of independent research.

4. The trainees in science and mathematics education met as separate groups for a minimum of one two hour seminar per week to discuss the research needs and problems of science and mathematics education respectively.

5. Professional Education course requirements.

Statistical Method Applied to Education 3 cr. (A)

Intermediate Statistics 3 cr. (A)

Multivariant Analysis 3 cr. (B)

Statistical Analysis and Research Design 3 cr. (B)

Computers 2-3 cr. (A)

Foundations of Educational Measurement 3 cr. (B)

Curriculum Construction 3 cr. (A)

Philosophy of Education 3 cr. (B)

[(A) - all students completed]

[(B) - depends upon interests of student]

Science Education

Advanced Problems in Science Education 3 cr. (X)

Science in the Elementary School 3 cr. (X)

Seminar in Science Education 2 cr. (X)

[(X) - Science Education Students]

Mathematics in the Secondary School 3 cr. (Y)

Mathematics in the Elementary School 3 cr. (Y)

Seminar in Mathematics Education 2 cr. (Y)

[(Y) - Mathematics Education Students]

Faculty

Dr. Jack A. Reed - Science Education. Ph.D. - University of Illinois - 1966.

Experience - Eastern Illinois University, 60-63; University of Illinois, 64-65; Southeast Missouri State College, 65-67; Northern Nigeria Teacher Education Project, 67-69.

Publications - Biology, A Guide for Teachers, Bulletin No. 1316, 1966, State of Missouri Teacher Inservice Education Program--Ahmadu Bello University, Nigeria, 1968. A Guide for Teaching First Year Science--Northern Nigeria, 1969. (with others)

Assignment - Assistant Professor, Department of Curriculum and Instruction

Dr. Alan Voelker - Science Education. Ph.D. - University of Wisconsin - 1967.

Experience - Ohio State University, 67-69

Publications - Teaching Concepts of Physical and Chemical Change, Journal of Research in Science Teaching No. 5, 1969. "Concept Teaching and the Nature of the Scientific Enterprise," School Science and Mathematics, Vol. 69, 1969.

Assignment - Assistant Professor, Wisconsin R & D Center and Department of Curriculum and Instruction.

Dr. Thomas Romberg - Ph.D. Stanford University, 1967.

Experience - SMSG Writing Team 1964.

Publication - "A Note on Multiplying Fractions" - The Arithmetic Teacher, March 1968. "The Development of Mathematics Achievement Tests for National Longitudinal Study of Mathematical Abilities." The Arithmetic Teacher, May 1968. "Survey Research: Guidelines for Status Studies," The Arithmetic Teacher, November 1968.

Assignment - Associate Director, Wisconsin R & D Center, Associate Professor, Wisconsin R & D Center and Department of Curriculum and Instruction.

Dr. John J. Harvey - Mathematics Education. Ph.D. - Tulane University - 1961.

Publications - "Complete Holomorphs," Pacific Journal of Mathematics, Vol. 11, 1961. "The Hahn Embedding Theorem for Abelian Lattice-ordered groups," Transaction of the American Mathematical Society, Vol. 108, 1963. "Teachers' Guide for Developing Mathematical Processes," Wisconsin R & D Center, 1968 (with Romberg). "Background of Projections," Wisconsin R & D Center, Department of Mathematics, and Curriculum and Instruction.

Dr. Henry Van Engen - Mathematics Education

Assignment - Emeritus Professor, Department of Mathematics and Curriculum and Instruction.

Dr. Milton O. Pella - Science Education

Assignment - Professor, Department of Curriculum and Instruction and Wisconsin R & D Center. Director of U.S.O.E. Research Training Program.

C. Trainees

1. Selection

Applicants were solicited through the wide distribution of a duplicated publication that included a description of the program and the method and deadline of application. All applications were received on a standard form. Those applications received by April 1 were summarized as to: 1, GPA, 2. Age, 3. Statement of purpose, 4. Depth and breadth of academic preparation, 5. Nature of experience, and 6. Judged potential.

The most promising candidates were selected by a committee of professors of science and mathematics education. There were generally five trainees each in science and mathematics education in residence per year.

2. Enrollment by year

1966-67

Program Year

1. Benzinger, Thomas L.
   Boles, Donald J.
   Janke, Delmar L.
   King, Irvin L.
   Niedfeldt, Gerald W.
   Shepler, Jack L.
   Sherman, Jack E.
   Swartney, Ilene J.
   Thompson, Walter
   Weinbrenner, Leroy B.
2. None
3. None

1967-68

Program Year

1. None
2. Benzinger, Thomas L. (withdrew at end of year)

   Boles, Donald (completed)

   Janke, Delmar L.

   King, Irvin L.

   Niedfeldt, Gerald W. (withdrew at end of year)

   Shepler, Jack L.

   Sherman, Jack (completed)

   Swartney, Joyce (completed)

   Thompson, Walter (withdrew at end of year)

   Weinbrenner, Leroy B.
3. None

1968-69

Program Year

1. Agin, Mike L.

   Carpenter, Thomas P.

   Grouws, Douglas A.

   Huffman, Gary E. (withdrew during first semester)

   Swan, Jack A.

   Thompson, Benjamin E.
2. None
3. Janke, Delmar L. (completed)

   King, Irvin L. (completed)

   Shepler, Jack I. (completed)

   Weinbrenner, Leroy B. (completed)

1969-70

Program Year

1. Foster, Thomas E.
   Hartman, Dean D.
   Hunsaker, David D. (withdrew)
   Montague, Margariete A.
   Reed, Ralph K. (withdrew)
2. Agin, Michael L. (completed)
   Carpenter, Thomas P.
   Grouws, Douglas A.
   Swan, Jack A. (completed)
   Thompson, Benjamin E. (completed)
3. None

1970-71

Program Year

1. Palmer, Glenn
   Wall, Charles (withdrew)
   Wiles, Clyde
2. Foster, Thomas (completed)
   Hartman, Dean (completed)
   Montague, Margariete A. (completed)
   Ogden, William
   Reed, Ralph (withdrew)
3. Carpenter, Thomas (completed)
   Grouws, Douglas (completed)

1971-72

Program Year

1. None
2. Hobbs, Charles (continuing)

   Palmer, Glenn (completed)

   Rowe, Ronald (continuing)

   Wiles, Clyde (continuing)
3. Ogden, William (completed)

   Roy, Robert (withdrew)

3. Period of Support for Trainees in Years

Number Graduated	Number Withdrew	Number Continuing
Boles (2)	Huffman (1)	Rowe (1)
Sherman (2)	Hunsaker (1)	Wiles (2)
Swartney (2)	Wall (1)	Hobbs (1)
Janke (3)	Benzinger (2)	
Shepler (3)	Niedfeldt (2)	
Weinbrenner (3)	Thompson, W. (2)	
Agin (2)	Reed (2)	
Swan (2)	Roy (1)	
Thompson, B. (2)		
King (3)		
Foster (2)		
Hartman (2)		
Montague (2)		
Carpenter (3)		
Grouws (3)		
Palmer (2)		
Ogden (3)		

4. Geographic Origins of Trainees

Arizona	(1)
California	(3)
Colorado	(1)
Florida	(1)
Idaho	(1)
Illinois	(2)
Indiana	(1)
Michigan	(2)
Montana	(1)
New York	(2)
North Dakota	(1)
Oklahoma	(1)
Pennsylvania	(1)
South Dakota	(2)
Texas	(2)
Wisconsin	(6)

5. Titles of Dissertations

Boles - "The Feasibility of Teaching Biology Via the Socio-Historical Approach." 1968.

Sherman - "The Relative Effectiveness of Two Methods of Utilizing Laboratory-Type Activities in Teaching Introductory Physical Science." 1968.

Swartney - "Learning Difficulties Encountered by Students Studying the CHEM Study Program." 1968.

Janke - "The Concept Currency of K-12 Textbooks Relative to Earth Science." 1969.

Shepler - "A Study of Parts of the Development of a Unit in Probability in Statistics for the Elementary School." 1969.

Weinbrenner - "Science Classificatory Dimensions and Rules Used by Children." 1969.

Agin - "The Feasibility of Teaching Science Via a Socio-Historical Approach." 1970.

Swan - An Assessment of the Characteristics of Piaget's Formal Periods of Intellectual Development Measures of Combinatorial Operations in Propositional Thinking. (Proposal).

Thompson - "Biological Concepts Appropriate for Inclusion in Grades K-12." 1970.

Foster - "Computer Programmed Individualized Instruction in Mathematics."

King - "A Formative Development of a Unit on Proof for Use in the Elementary School." 1969.

Hartman - "The Construction and Validity of an Attitude Inventory toward Science and Technology." 1972.

Montague - "Use of Matrix Sampling Procedures with Selected Examinee and Hem Populations to Assess Achievement in Mathematics." 1971.

Carpenter - "An Investigation of Several Factors Underlying Conservation of Quantity and Numerousness."

Grouws - "Differential Performance of Third-Grade Children in Solving Open Sentences of Four Types." 1971.

Palmer - "A Technique to Determine the Stability of Pupil Interests in Science." 1972.

Ogden - "Chronological History of the Objectives for Teaching Chemistry 1920-1970." 1972.

Continuing Students

Hobbs - "An Indepth Analysis of Errors in the Use of the Distributive Property."

Rowe - "Teaching Objectives for Science in the Middle Schools."

Wiles - "Teaching the Algorithms of Addition and Subtraction involving Two Digit Whole Numbers."

6. Locations of Graduates

Boles, Ronald . Central Washington State University
Ellensburg, Washington 98926
Associate Professor of Biology Education

Janke, Delmar	Texas A & M
	College of Education
	College Station, Texas 77843
King, Irvin	University Laboratory School
	University of Hawaii
	Honolulu, Hawaii 96822
	Chairman - Laboratory School
	Department of Mathematics
Shepler, Irvin	University of Pennsylvania
	Indiana, Pennsylvania
	Assistant Professor Mathematics Education
Swartney, Joyce	State University College
	Buffalo, New York 14222
	Assistant Professor Science Education
Weinbrenner, Leroy	Trinity College
	Deerfield, Illinois 60015
	Assistant Professor of Science Education
Sherman, Jack	University of Colorado
	Colorado Springs, Colorado 80907
	Assistant Professor of Science Education
Montague, Margariete	University of Wyoming
Grouws, Douglas	University of Missouri
	Columbia, Missouri

Carpenter, Thomas P.	Boston University
	Boston, Massachusetts
Foster, Thomas	Sam Houston College
	Texas
Agin, Michael L.	Michigan Technological University
	Houghton, Michigan
	Assistant Professor of Science Education
Thompson, Benjamin E.	Wisconsin State University
	Eau Claire, Wisconsin
	Assistant Professor of Science Education
Swan, Jack A.	Eastern Washington University
	Cheney, Washington
	Department of Mathematics
Hartman, Dean	State Department of Education, Iowa
	Cedar Falls, Iowa
Palmer, Glenn	Rider College
	New Jersey
Ogden, William	East Texas State University
	Commerce, Texas
Hobbs, C. E.	University of Wisconsin - Assistant
Rowe, Ronald	University of Wisconsin - Assistant
Wiles, Clyde	University of Wisconsin - R & D Center